Scaling and Process Challenges in Micro-EDM Technology

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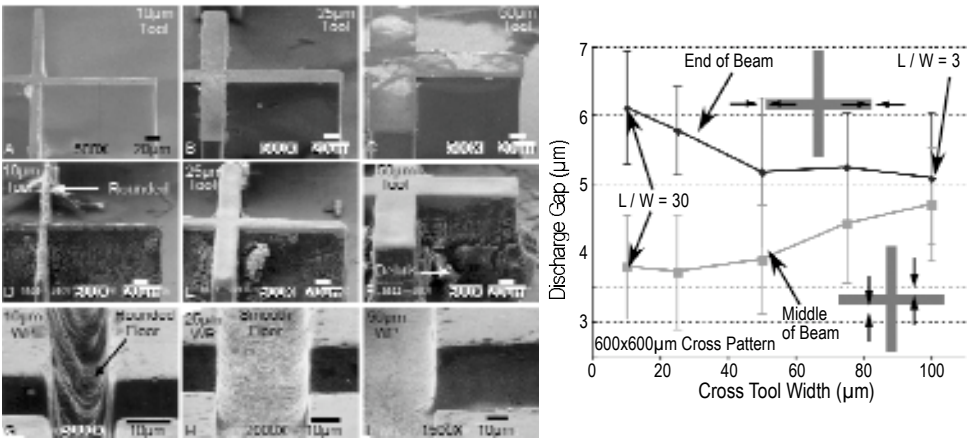

Left– SEM survey of cross features, Right – Impact of cross tool width and location on the discharge gap.

High-density patterns in batch mode micro-Electro-Discharge Machining (μEDM) present challenges due to debris build-up. Batch mode μEDM involves the use of lithographically fabricated tools to pattern bulk metal workpieces. The goals of this project are to improve both precision and feature density and to refine integration between μEDM and the LIGA process. This will yield direct improvements in batch mode μEDM of bulk metal devices such as cardiovascular stents, RF switches, and power relays. Machining by μEDM involves the sequential discharge of electrical pulses between a metal electrode and sample in a dielectric fluid. Batch mode operation is realized using a LIGA-type process to fabricate electrode arrays, but debris buildup is a problem for high-density patterns. A resolution study was performed to investigate the impact of debris buildup. The figure on the left shows an SEM survey of cross features, and the figure on the right shows how discharge gap varies with location and tool width. Electrodes have been developed with built-in debris removal features such as through-hole flushing. This improves edge and surface finish of machined parts and allows high-density features to be machined. Additionally, a passivated sidewall coating on the machining tool suppresses spurious discharges from debris build-up that eventually destroys both tool and workpiece. This project has been supported in part by Sandia National Laboratories and by the Engineering Research Centers Program of the National Science Foundation under award number EEC-9986866.